

# ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804

Declaration holder	Deutsche Bauchemie e.V. Industrieverband Klebstoffe e.V. Verband der deutschen Lack- und Druckfarbenindustrie e.V.
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**Reactive resins based on polyurethane, unfilled/solvent-free, containing polyols**

**Deutsche Bauchemie e.V. (DBC)  
Industrieverband Klebstoffe e.V. (IVK)  
Verband der deutschen Lack- und  
Druckfarbenindustrie e.V. (VdL)**

[www.bau-umwelt.com](http://www.bau-umwelt.com) / <https://epd-online.com>



Institut Bauen  
und Umwelt e.V.

 **DEUTSCHE  
BAUCHEMIE**

 **Industrieverband  
Klebstoffe e.V.**

 **Verband der deutschen  
Lack- und Druckfarbenindustrie e.V.**



## 1. General information

**Deutsche Bauchemie e.V.  
Industrieverband Klebstoffe e.V.  
Verband der deutschen Lack- und  
Druckfarbenindustrie e.V.**

**Programme holder**

IBU – Institut Bauen und Umwelt e.V.  
Rheinufer 108  
D-53639 Königswinter

**Declaration number**

EPD-DBC-20130014-IBG1-E

**This Declaration is based on the Product Category Rules:**

Reactive resin products, 10-2012  
(PCR tested and approved by the independent Expert Committee (SVA))

**Issue date**

15.05.2013

**Valid until:**

14.05.2018

Prof. Dr.-Ing. Horst J. Bossenmayer  
(President of Institut Bauen und Umwelt e.V.)

Prof. Dr.-Ing. Hans-Wolf Reinhardt  
(Chairman of the Expert Committee (SVA))

**Reactive resins based on  
polyurethane, unfilled/solvent-free,  
containing polyols**

**Owner of the Declaration**

Deutsche Bauchemie e.V.  
Mainzer Landstrasse 55  
60329 Frankfurt

Industrieverband Klebstoffe e.V.  
Völklinger Strasse 4  
40219 Düsseldorf

Verband der deutschen Lack- und  
Druckfarbenindustrie e.V.  
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60329 Frankfurt

**Declared product/unit**

1 kg reactive resin based on polyurethane, unfilled/solvent-free, containing polyols; density 0.85 - 1.25 g/cm<sup>3</sup>

**Area of applicability:**

This validated Declaration entitles the holder to bear the symbol of the Institut Bauen und Umwelt e.V. It exclusively applies for the product groups referred to for plants in Germany and for a period of five years from the date of issue. It involves an association EPD where the product displaying the highest environmental impact in a group was selected for calculating the Life Cycle Assessment. The members of the associations are shown on the association Web sites. The holder of the Declaration is liable for the information and evidence on which it is based; IBU accepts no liability for manufacturer's information, LCA data and evidence.

**Verification**

The CEN EN 15804 standard serves as the core PCR.

Verification of the EPD by an independent third party in accordance with ISO 14025

internally  externally

Dr.-Ing. Ivo Mersiowsky  
Independent auditor appointed by the SVA

## 2. Product

### 2.1 Product description

*Reactive resins based on polyurethane, unfilled/solvent-free*

These single- or two-component reactive resins are manufactured using polyols (based on mineral oil or from sustainable raw materials) and isocyanates. They fulfil manifold, often specific, tasks in the construction, furnishing and repair of buildings. Using reactive resins based on polyurethane, unfilled/solvent-free, decisively improves the fitness for use of structures and significantly extends their service lives.

The product displaying the most environmental impacts was applied as a representative product for calculating the Life Cycle Assessment results.

### 2.2 Application

Reactive resins based on polyurethane, unfilled/solvent-free, are used for the following applications:

**Module 1:**

*Reactive resins for protecting and repairing concrete structures*

Products for **surface protection of concrete**, for increasing the durability of concrete and reinforced

concrete structures as well as for new concrete and for maintenance and repair work (requirements 1.1), products for **structural bonding** of strengthening materials to an existing concrete structure (requirements 1.2) and **products for concrete injection** for filling cracks, voids and interstices in concrete (requirements 1.3)

**Module 2:**

*Liquid-applied roof waterproofing kits*

Reactive resins for waterproofing roof constructions which are applied on site

**Module 3:**

*Reactive resins for liquid-applied bridge deck waterproofing kits*

Products for liquid-applied waterproofing for use on concrete bridge decks

**Module 4:**

*Reactive resins as adhesive for tiles*

Tile adhesives for internal and external tile installations on walls, floors and ceilings

**Module 5:**

*Reactive resins for watertight covering kits*

Products for waterproofing floors and/or walls in wet rooms inside buildings

**Module 6:**

*Reactive resins for liquid-applied waterproofing for buildings*

Liquid-applied plastics for waterproofing buildings

**Module 7:**

*Screed material and floor screeds*

Products for screed / synthetic resin screed for use in floor constructions

**Module 8:**

*Adhesives and sealants*

Reactive resins for use as:

- Structural and repair adhesives
- Surface and joint sealants

Applications in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

**Module 9:**

*Reactive resins for waterproofing concrete components or masonry and for pre-treating mineral substrates such as screed or concrete floors prior to flooring, parquet and tile work*

Applications in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

**Module 10:**

*Reactive resins for visual design of concrete components*

Products for usually coloured design of concrete with simultaneous, unspecific surface protection and improved permanence of concrete and reinforced concrete surfaces. The same applies for other mineral substrates such as plaster, stone and masonry, for example.

Owing to the currently higher material price of polyurethane and poorer adhesion to critical partial areas (such as glass and metal components) in components, only the final coating is often applied based on polyurethane in multiple-layer applications and one or more layers of epoxy resin applied beforehand.

**2.3 Technical data**

**Module 1:**

*Reactive resins for protecting and repairing concrete structures*

The minimum requirements of DIN EN 1504 "Products and systems for the protection and repair of concrete

structures – Definitions, requirements, quality control and evaluation of conformity" must be maintained.

These are:

1.1 **Surface protection** systems for concrete –

Requirements on performance characteristics for all intended uses in accordance with EN 1504-2:2005-01, Tables 1 and 5:

- Permeability to CO<sub>2</sub> (EN 1062-6:2002)
- Water vapour permeability (EN ISO 7783-1/-2:2012-02)
- Capillary absorption and permeability to water (EN 1062-3:2008-04)
- Adhesion strength by pull-off test (EN 1542:1999-07)

1.2 Products for structural bonding – Performance characteristics for all intended uses in accordance with Tables 3.1 and 3.2 (manufacturer's Declaration of Conformity / Declaration of Performance)

1.3 **Products for concrete injection** for filling cracks, voids and interstices in concrete – Requirements on performance characteristics for all intended uses in accordance with EN 1504-5, Table 3

- Injectability (EN 1771:2004-11)
- Viscosity (EN ISO 3219:1994-10)

Other performance characteristics in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

**Module 2:**

*Liquid-applied roof waterproofing kits*

The minimum requirements of ETAG 005:2005-02 "Guideline for the European technical approval for liquid-applied roof waterproofing kits" must be maintained.

The performance characteristics must be indicated in accordance with the European Technical Approval (ETA no.).

**Module 3:**

*Liquid-applied bridge deck waterproofing kits*

3.1 The requirements of ZTV ING Part 7, section 3 (ZTV BEL-B Part 3) must be maintained.

The minimum requirements of ETAG 033:2010-09 "Guideline for the European technical approval for liquid-applied bridge deck waterproofing kits" must be maintained.

The performance characteristics must be indicated in accordance with the European Technical Approval (ETA no.).

**Module 4:**

*Adhesive for tiles*

The minimum requirements of DIN EN 12004:2012-09 "Adhesives for tiles – Requirements, evaluation of conformity, classification and designation" must be maintained. These are:

- Initial shear adhesion strength (EN 12003:2009-01)
- Shear adhesive strength after water immersion (EN 12003:2009-01)
- Open time: tensile adhesion strength (EN 13892:2007-11)

Other performance characteristics in accordance with the manufacturer's technical documentation / declaration of performance / declaration of conformity

**Module 5:**

*Watertight covering kits*

5.1 The minimum requirements of ETAG 022:2007-07 "Guideline for the European Technical Approval of watertight covering kits for wet room floors and/or walls" must be maintained.

The performance characteristics must be indicated in accordance with the European Technical Approval (ETA no.).

5.2 The minimum requirements of the "Testing principles for granting a general building authority approved test certificate for liquid applied waterproofing materials used in conjunction with tiles and paving. Part 1: Liquid waterproofing materials (PG-AIV-F)" must be maintained.

The characteristics in accordance with the "Testing principles for granting a general building authority approved test certificate for waterproofing materials used in conjunction with tiles and paving . Part 1: Liquid waterproofing materials (PG-AIV-F)" must be indicated.

**Module 6:**

*Liquid-applied waterproofings for buildings*

The minimum requirements of the "Testing principles for granting a general building authority approved test certificate for waterproofing buildings with liquid-applied plastics" must be maintained.

The characteristics for the proof of applicability must be indicated in accordance with the "Testing principles for granting a general building authority approved test certificate for waterproofing buildings with liquid applied plastics".

**Module 7:**

*Screed material and floor screeds*

The minimum requirements of EN 13813 "Screed material and floor screeds – Screed materials – Properties and requirements" must be maintained. For synthetic resin screeds, these are:

- Bond strength (EN 13892-8)
- Reaction to fire (EN 13501-1)

Other performance characteristics in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

**Module 8:**

*Adhesives and sealants*

Performance characteristics in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

**Module 9:**

*Reactive resins for waterproofing concrete components or masonry and for pre-treating mineral substrates such as screed or concrete floors prior to flooring, parquet and tile work*

At least the following requirements must be fulfilled:

Characteristic	Standard	Unit	Value
Viscosity	EN ISO 3219:1994-10	Pa·s	< 100
Shore hardness A	DIN 53505:2008-08	-	15 – 100
Shore hardness D	DIN 53505:2008-08	-	5 – 95
Density	EN ISO 2811:2011-06	kg/dm <sup>3</sup>	0.7 – 1.8

Other performance characteristics in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

**Module 10:**

*Reactive resins for visual design of concrete components*

Physical data on the coating material and/or coating must be indicated in accordance with the respective product standards; these can include, for example:

- Viscosity EN ISO 3219:1994-10
- Density EN ISO 2811:2011-06
- Pendulum damping ISO 1522:2007-04
- Reaction to fire EN 13501-1:2010-01
- Tensile strength EN 13892-8:2003-02

Other performance characteristics in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

**2.4 Placing on the market / Application rules**

**Module 1:**

*Reactive resins for protecting and repairing concrete components*

A prerequisite for placing the product on the market and application in Germany is the CE marking of the products.

Before 30 June 2013, the legal basis for this is represented by Council Directive 89/106/EEC; as of 1 July 2013, Directive (EU) no. 305/2011 of the European Parliament and Council (ABl. I 88/5 dated 4.4.2011) shall apply in national law along with the respective implementation guidelines. Construction products placed on the market prior to 1 July 2013 in compliance with Directive 89/106/EEC are regarded as being conformant with Directive (EU) no.305/2011. CE marking based on Directive 89/106/EEC confirms conformity with the technical specifications. This is the DIN EN 1504 ~ "Products and systems for the protection and repair of concrete structures".

CE marking in accordance with Directive (EU) no. 305/2011 confirms conformity with its declared performance.

As for the rest, the provisions in Part II of the list of technical building regulations shall apply.

**Module 2:**

*Liquid-applied roof waterproofing kits*

A prerequisite for placing the product on the market and application in Germany is the CE marking of the products.

Before 30 June 2013, the legal basis for this is represented by Council Directive 89/106/EEC; as of 1 July 2013, Directive (EU) no. 305/2011 of the European Parliament and Council (ABl. I 88/5 dated 4.4.2011) shall apply in national law along with the respective implementation guidelines. Construction products placed on the market prior to 1 July 2013 in compliance with Directive 89/106/EEC are regarded as being conformant with Directive (EU) no.305/2011. CE marking based on Directive 89/106/EEC confirms conformity with the technical specifications. This is the ETAG 005:2005-02 "Guideline for the European technical approval for liquid-applied roof waterproofing kits".

CE marking in accordance with Directive (EU) no. 305/2011 confirms conformity with its declared performance.

As for the rest, the provisions in Part II of the list of technical building regulations shall apply.

**Module 3:**

*Liquid-applied bridge deck waterproofing kits*

Before 30 June 2013, the legal basis for this is represented by Council Directive 89/106/EEC; as of 1 July 2013, Directive (EU) no. 305/2011 of the European Parliament and Council (ABl. I 88/5 dated 4.4.2011) shall apply in national law along with the respective implementation guidelines. Construction products placed on the market prior to 1 July 2013 in compliance with Directive 89/106/EEC are regarded as being conformant with Directive (EU) no.305/2011. CE marking based on Directive 89/106/EEC confirms conformity with the technical specifications. This is the ETAG 033:2010-07 "Guideline for the European technical approval for liquid-applied bridge deck waterproofing kits".

CE marking in accordance with Directive (EU) no. 305/2011 confirms conformity with its declared performance.

As for the rest, the provisions in Part II of the list of technical building regulations shall apply. Special applications can also be regulated in accordance with ZTV ING.

**Module 4:**

*Adhesives for tiles*

A prerequisite for placing the product on the market and application in Germany is the CE marking of the products.

Before 30 June 2013, the legal basis for this is represented by Council Directive 89/106/EEC; as of 1 July 2013, Directive (EU) no. 305/2011 of the European Parliament and Council (ABl. I 88/5 dated 4.4.2011) shall apply in national law along with the respective implementation guidelines. Construction products placed on the market prior to 1 July 2013 in compliance with Directive 89/106/EEC are regarded as being conformant with Directive (EU) no.305/2011. CE marking based on Directive 89/106/EEC confirms conformity with the technical specifications. This is DIN EN 12004 ~ "Adhesives for tiles – Requirements, evaluation of conformity, classification and designation".

CE marking in accordance with Directive (EU) no. 305/2011 confirms conformity with its declared performance.

As for the rest, the provisions in Part II of the list of technical building regulations shall apply.

**Module 5:**

*Watertight covering kits*

**Module 5.1:**

A prerequisite for placing the product on the market and application in Germany is the CE marking of the products.

Before 30 June 2013, the legal basis for this is represented by Council Directive 89/106/EEC; as of 1 July 2013, Directive (EU) no. 305/2011 of the European Parliament and Council (ABl. I 88/5 dated 4.4.2011) shall apply in national law along with the respective implementation guidelines. Construction products placed on the market prior to 1 July 2013 in compliance with Directive 89/106/EEC are regarded as being conformant with Directive (EU) no.305/2011. CE marking based on Directive 89/106/EEC confirms conformity with the technical specifications. This is the ETAG 022:2005-02 "Guideline for the European technical approval for watertight covering kits for wet room floors and or walls".

CE marking in accordance with Directive (EU) no. 305/2011 confirms conformity with its declared performance.

As for the rest, the provisions in Part II of the list of technical building regulations shall apply.

**Module 5.2:**

A prerequisite for application in Germany is the marking of the products with the mark of conformity (Ü symbol) based on a general building authority test certificate (abP) in accordance with Building Regulation List A, Part 2, consec. no. 2.50.

**Module 6:**

*Liquid-applied waterproofing for buildings*

A prerequisite for application in Germany is the marking of the products with the mark of conformity (Ü symbol) based on a general building authority test certificate (abP) in accordance with Building Regulation List A, Part 2, consec. no. 2.51.

**Module 7:**

*Screed material and floor screeds*

A prerequisite for placing the product on the market and application in Germany is the CE marking of the products.

Before 30 June 2013, the legal basis for this is represented by Council Directive 89/106/EEC; as of 1 July 2013, Directive (EU) no. 305/2011 of the European Parliament and Council (ABl. I 88/5 dated 4.4.2011) shall apply in national law along with the respective implementation guidelines. Construction products placed on the market prior to 1 July 2013 in compliance with Directive 89/106/EEC are regarded as being conformant with Directive (EU) no.305/2011. CE marking based on Directive 89/106/EEC confirms conformity with the technical specifications. This is the DIN EN 13813 "Screed material and floor screeds – Screed materials – Properties and requirements". CE marking in accordance with Directive (EU) no. 305/2011 confirms conformity with its declared performance.

As for the rest, the provisions in Part II of the list of technical building regulations shall apply.

**Module 8:**

*Adhesives and sealants*

Applications in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

**Module 9:**

*Reactive resins for waterproofing concrete components or masonry and for pre-treating mineral substrates such as screed or concrete floors prior to flooring, parquet and tile work*

The DIN 18356:2012-10 and DIN 18365:2012-09 or comparable national or international rules (see CEN/TS 14472:2003-10, Parts 1-4 and CEN/TS 15717:2008-07) are of relevance for carrying out parquet and flooring work.

Special applications in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

**Module 10:**

*Reactive resins for visual design of concrete components*

If available, the respective standard and/or general technical approval or comparable national or international regulation must be indicated. Special applications in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

**2.5 Delivery status**

Liquid or pasty in containers made of tinfoil or plastic appropriately prepared in separate or combi-containers for the practical mixing ratio. One kg of product in individual containers. Sealants in plastic cartridges and poly-tube bags made of foil compound materials.

Typical container sizes contain 10 to 25 kg of material; for more extensive applications, vats containing approx. 200 kg or IBCs containing more than 1 tonne are also used.

A ratio of 1:2 for tinfoil to plastic packaging was assumed for the Life Cycle Assessment.

**2.6 Base materials / Auxiliaries**

The reactive resins based on polyurethane, unfilled/solvent-free, usually comprise resin and hardening agent components. The resin component contains polyether and/or polyester polyols (based on mineral oil or from sustainable raw materials). hardening takes place after installation on site and

using the hardening component. This involves the use of homologues, pre-polymers and polymers based on MDI, TDI, HDI or IPDI. The components can contain auxiliaries such as accelerators, catalysts, wetting agents, foam regulators and viscosity regulators for fine-tuning the product features (application or marketing restrictions must be adhered to). The resin and hardening agent mixing ratio is adjusted according to the stoichiometric requirements. Product hardening commences directly after the components are mixed. There are also single-component products which harden in the presence of moisture without adding a resin component. On average, the products covered by this EPD contain the following ranges of base materials and auxiliaries referred to:

Resin component: ~ 35-95%  
Hardening agent component: ~ 5-65%

These ranges are average values and the composition of products complying with the EPD can deviate from these concentration levels in individual cases. More detailed information is available in the respective manufacturer's documentation (e.g. product data sheets).

In individual cases, it is possible that substances on the list of materials of particularly high concern for inclusion in Annex XIV of the REACH regulation are contained in concentrations exceeding 0.1%. If this is the case, this information can be found on the respective safety data sheet.

## 2.7 Production

The product components formulated are usually mixed from the ingredients in batch mode and packaged for delivery, whereby quality and environmental standards in accordance with DIN ISO 9001:2008-12 and the provisions outlined in the relevant regulations such as the Industrial Safety Regulation and Federal Pollution Control Act are adhered to.

## 2.8 Environment and health during production

As a general rule, no other environmental protection measures other than those specified by law are necessary.

## 2.9 Product processing / Installation

Reactive resins based on polyurethane, unfilled/solvent-free, are processed by trowelling/knife-coating or rolling, pouring, spraying or injection, whereby health and safety measures (ventilation, respiratory equipment) are to be taken and consistently adhered to in accordance with the information on the safety data sheet and conditions on site. On account of their composition, solvent-free polyurethane products bear the GISCODE/Gisbau product code RU 1 or PU 40.

## 2.10 Packaging

A detailed description of packaging is provided in section 2.5. Empty containers and clean foils can be recycled. Wooden reusable pallets are taken back by the building material trade (reusable pallets remunerated in the German deposit system) which returns them to the construction product manufacturer who in turn redirects them into the production process.

## 2.11 Condition of use

During the use phase, reactive resins based on polyurethane, unfilled/solvent-free, are hardened and essentially comprise an inert three-dimensional network.

They are long-lasting products which protect our buildings in the form of adhesives, coatings or sealants as well as making an essential contribution towards their function and conservation of value.

## 2.12 Environment and health during use

### Option 1

#### **Products for applications outside indoor areas with permanent stays by people**

During use, reactive resins based on polyurethane, unfilled/solvent-free, lose their reactive capacity and are inert.

No risks are known for water, air and soil if the products are used as designated.

### Option 2

#### **Products for applications inside indoor areas with permanent stays by people**

When used in indoor areas with permanent stays by people, evidence of the emission performance of construction products in contact with indoor air must be submitted. These can be in accordance with the following test schemes, for example: AgBB-VOC scheme, EMICODE® of the GEV (Gemeinschaft Emissionskontrollierte Verlegewerkstoffe, Klebstoffe und Bauprodukte e.V., Düsseldorf). No further influences by emissions on the environment and health are known.

## 2.13 Reference service life

Reactive resins based on polyurethane, unfilled/solvent-free, comply with a variety of, often specific, tasks in the construction or refurbishment of building structures. They decisively improve the usability of building structures and significantly extend their original service lives.

The anticipated reference service life depends on the specific installation situation and the exposure associated with the product. It can be influenced by weathering as well as mechanical or chemical loads.

## 2.14 Extraordinary effects

### Fire

Even without any special fire safety features, reactive resins based on polyurethane or SMP, filled or aqueous/solvent-free, comply with at least the requirements of DIN EN 13501-1 standard for fire classes E and E<sub>fl</sub>. In terms of the volumes applied, they only have a subordinate influence on the fire performance characteristics of the building structure in which they are installed. As networked polyurethane resins do not melt or drip, the resins do not contribute towards spreading fire.

### Water

The reactive resins based on polyurethane, unfilled/solvent-free, are chemically inert and insoluble in water. They are often used to protect building structures from harmful water ingress / the effects of flooding.

### Mechanical destruction

The mechanical destruction of reactive resins based on polyurethane does not lead to any decomposition products which are harmful for the environment or health.

### 2.15 Re-use phase

According to present knowledge, no environmentally-hazardous effects in terms of landfilling are to be generally anticipated through dismantling and recycling components to which hardened polyurethane products adhere.

If polyurethane systems can be removed from the components at no great effort, thermal recovery is a practical recycling variant on account of its energy content.

### 2.16 Disposal

Individual components which can no longer be recycled must be combined at a specified ratio and hardened.

Hardened product residue is not special waste.

Non-hardened product residue is special waste.

Empty, dried containers (free of drops and scraped clean) are directed to the recycling process.

Residue must be directed to proper waste disposal taking consideration of local guidelines.

The following EWC/AVV waste codes can apply:

Hardened product residue:

080112 Paint and varnish waste with the exception of those covered by 08 01 11

080410 Adhesive and sealant compound waste with the exception of those covered by 08 04 09

### 2.17 Further information

More information is available in the manufacturer's product or safety data sheets and is available on the manufacturer's websites or on request. Valuable technical information is also available on the associations' websites.

TKB instructions, for example, are available at [www.klebstoffe.com](http://www.klebstoffe.com) or information on Deutsche Bauchemie is available at [www.deutsche-bauchemie.de](http://www.deutsche-bauchemie.de).

## 3. LCA: Calculation rules

### 3.1 Declared unit

The association EPD refers to the declared unit of 1 kg reactive resin product in the mixing ratio required for processing both components. Consumption per unit area of the products to be applied extensively can range between only a few hundred grams and more than 1 kg per square metre. In the case of products which are injected, the application volume depends on the component to be injected.

An LCA for unfilled, solvent-free, reactive resin products containing polyols and based on PU was calculated in this EPD.

The product with the highest environmental impact in the product groups was declared.

#### Declared unit

Description	Value	Unit
Declared unit	1	kg
Conversion factor to 1 kg	1	-

### 3.2 System boundary

Modules A1/A2/A3, A4, A5 and D are taken into consideration in the LCA:

- A1 Manufacture of preliminary products
- A2 Transport to plant
- A3 Production incl. provision of energy, manufacture of packaging, auxiliaries and consumables, waste treatment)
- A4 Transport to site
- A5 Installation (disposal of packaging and emissions during installation)
- D Credits from incineration of packaging materials and recycling the metal container

The Declaration is therefore from the "cradle to plant gate, with options".

### 3.3 Estimates and assumptions

Where no specific GaBi processes were available, the individual recipe ingredients of formulae were estimated on the basis of information provided by the manufacturer or literary sources.

### 3.4 Cut-off criteria

No cut-off criteria were applied for calculating the LCA. All raw materials submitted by the associations for the formulae were taken into consideration.

The manufacture of machinery, plants and other infrastructure required for production of the products under review was not taken into consideration in the LCA.

### 3.5 Background data

Data from the GaBi 5 data base was used as background data. Where no background data was available, it was supplemented by manufacturer information and literary research.

### 3.6 Data quality

Representative products were applied for this sample EPD and the product in a group displaying the highest environmental impact was applied for calculating the LCA results. The data sets are no more than 7 years old. The data was taken from the GaBi 5:2010 data bases and is therefore consistent.

### 3.7 Period under review

The review period concerns annual production for the year 2011.

### 3.8 Allocation

No allocations were applied for production. A multi-input allocation with a credit for electricity and thermal energy was used for incineration of packaging in accordance with the simple credit method. The credits achieved through packaging disposal are offset in Module D.

### 3.9 Comparability

As a general rule, a comparison or evaluation of EPD data is only possible when all of the data to be compared has been drawn up in accordance with DIN EN 15804 and the building context or product-specific characteristics are taken into consideration. In this case, 1 kg reactive resin was selected as the declared unit. Depending on the application, a corresponding

conversion factor such as the specific unit area must be taken into consideration.

## 4. LCA: Scenarios and additional technical information

The following technical information forms the basis for the declared modules or can be used for developing specific scenarios in the context of a building evaluation if modules are not declared (MND).

### Transport to site (A4)

Description	Value	Unit
Litres of fuel	0.0016	l/100 km
Transport distance	500	km
Capacity (incl. empty runs)	85	%
Gross density of products transported	900 - 1300	kg/m <sup>3</sup>
Volume capacity factor	100	-

### Construction installation process (A5)

Description	Value	Unit
Material loss	0.01	kg



## 5. LCA: Results

### SYSTEM BOUNDARIES (X = INCLUDED IN THE LCA; MND = MODULE NOT DECLARED)

Product stage			Construction process stage		Use stage								End-of-life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Production	Transport from manufacturer to site	Assembly	Use / Application	Maintenance	Repairs	Replacement	Renewal	Operational energy use	Operational water use	De-construction	Transport	Waste treatment	Landfilling	Re-use, recovery or recycling potential	
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X

### LCA RESULTS – ENVIRONMENTAL IMPACT: 1 kg PU reactive resin, solvent-free and unfilled

Parameter	Unit	A1 - A3	A4	A5	D
Global Warming Potential	[kg CO <sub>2</sub> equiv.]	5.87E+0	2.58E-2	1.25E-1	-1.25E-1
Ozone Depletion Potential	[kg CFC11 equiv.]	3.44E-8	1.38E-12	4.5E-12	-1.34E-10
Acidification Potential of soil and water	[kg SO <sub>2</sub> equiv.]	1.56E-2	1.64E-4	1.45E-5	-3.15E-4
Eutrophication Potential	[kg (PO <sub>4</sub> ) <sup>3-</sup> equiv.]	4.74E-3	4.06E-5	2.94E-6	-2.77E-5
Photochemical Ozone Creation Potential	[kg ethene equiv.]	2.91E-3	-7.03E-5	1.3E-6	-4.39E-5
Abiotic Depletion Potential non-Fossil Resources	[kg Sb equiv.]	3.74E-5	1.18E-9	1.82E-9	-6.35E-9
Abiotic Depletion Potential Fossil Resources	[MJ]	1.14E+2	3.56E-1	2.96E-2	-1.66E+0

### LCA RESULTS – USE OF RESOURCES: 1 kg PU reactive resin, solvent-free and unfilled

Parameter	Unit	A1 - A3	A4	A5	D
Renewable primary energy as energy carrier	[MJ]	3.86E+0	-	-	-
Renewable primary energy as material utilisation	[MJ]	0.0E+0	-	-	-
Total use of renewable primary energy sources	[MJ]	3.86E+0	1.42E-2	2.19E-3	-6.74E-2
Non-renewable primary energy as energy carrier	[MJ]	9.4E+1	-	-	-
Non-renewable primary energy as material utilisation	[MJ]	2.5E+1	-	-	-
Total use of non-renewable primary energy sources	[MJ]	1.19E+2	3.56E-1	2.96E-2	-1.66E+0
Use of secondary materials	[kg]	0.0E+0	-	-	-
Renewable secondary fuels	[MJ]	1.17E-3	3.01E-6	4.01E-7	7.66E-4
Non-renewable secondary fuels	[MJ]	1.22E-2	3.16E-5	4.2E-6	8.07E-3
Net use of fresh water	[m <sup>3</sup> ]	2.68E+0	1.32E-3	2.53E-3	-6.09E-2

### LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg PU reactive resin, solvent-free and unfilled

Parameter	Unit	A1 - A3	A4	A5	D
Hazardous waste for disposal	[kg]	-	-	-	-
Disposed of, non-hazardous waste	[kg]	5.1E+0	1.88E-3	5.94E-3	-6.31E-1
Disposed of, radioactive waste	[kg]	1.88E-3	5.03E-7	1.52E-6	-3.57E-5
Components for re-use	[kg]	-	-	-	-
Materials for recycling	[kg]	-	-	-	-
Materials for energy recovery	[kg]	-	-	-	-
Exported electrical energy	[MJ]	-	-	1.77E-1	-
Exported thermal energy	[MJ]	-	-	4.27E-1	-

"Hazardous waste for disposal" indicator: No Declaration in accordance with the Expert Committee (SVA) decision of 4.10.2012

## 6. LCA: Interpretation

On consideration of the results of **non-renewable primary energy requirements**, it is apparent that the greatest share (97%) is accounted for by the provision of preliminary products. The preliminary products used in the recipes are largely manufactured on the basis of crude oil and are associated with high energy requirements. The hardening agent components in particular are responsible for a relatively high percentage of the environmental impacts.

At less than 3% of overall primary energy, the share of **renewable primary energy** is very low. The contributions made by preliminary products (A1) and production (A3) to renewable primary requirements are obvious. In the case of A1, the renewable

percentage of the power mix is the main cause while the wooden pallets for packaging are responsible in A3 as solar energy is required for photosynthesis during wood production (growth).

The **Global Warming Potential (GWP)** is also dominated by the production of preliminary products. In terms of the GWP, the hardening agent components display higher environmental impacts than the resin component. Production (A3) contributes less than 5% to the GWP. None of the other life cycle phases have a significant influence on the GWP.

In the case of the **Ozone Depletion Potential (ODP)**, it is apparent that the influences are almost

exclusively necessitated by A1 and A3 which are primarily accounted for by halogenated organic emissions from the power mix used.

The **Acidification Potential (AP)** is primarily caused by nitric oxides and sulphur dioxide incurred during manufacture of the preliminary products. In the case of A3 (Production), electricity and manufacture of the containers play the main roles, accounting for approx. 3-4% of the AP. The results also depict transport to the site and the nitrogen emissions associated with this which, however, account for less than 1% of the AP.

Consideration of the **Eutrophication Potential (EP)** clearly indicates that this parameter is almost exclusively influenced by Manufacturing (A1) (> 95%). Others modules do not play any role of relevance.

The **Photochemical Ozone Creation Potential (POCP)** is also dominated by manufacture (A1). Production (A3) also makes a significant contribution (>15%) to the POCP. Apart from nitrogen monoxide and sulphur dioxide, NMVOCs are particularly responsible for the POCP.

## 7. Requisite evidence

### 7.1 VOC

Special tests and evidence have not been carried out or provided within the framework of drawing up this sample Environmental Product Declaration.

Where the products are used in an area of application (e.g. recreation area) demanding testing/provision of

VOC emissions in the recreation area, such evidence should always be submitted in the individual EPDs. Evidence pertaining to VOC can be listed for selected products or applications (e.g. recreation area). The following limit values apply (maximum values in [ $\mu\text{g}/\text{m}^3$ ]):

Classification/ EMICODE	EC1 Plus	EC1	EC2	RAL UZ 113 (*)	DIBt/AgBB
TVOC (C <sub>6</sub> -C <sub>16</sub> ) (after 3/28d)	750 / 60	1000 / 100	3000 / 300	1000 / 100	10000 / 1000
TSVOC (C <sub>16</sub> -C <sub>22</sub> ) (after 28d)	40	50	100	50	100
C1, C1 – Materials * Total after 3d ** for each material after 28d	10* / 1**	10* / 1**	10* / 1**	10* / 1**	10* / 1**
Total formaldehyde / acetaldehyde [ppb] (after 3d)	50/50	50/50	50/50	50/50	- / -
Total VOC without NIK and non-identifiable materials (after 28d)	40	-	-	40	100
R-value (after 28d)	1	-	-	1	1

(\*) e.g. for flooring adhesives; additional RAL UZ can be of relevance for other dispersion-based products.

**Measuring process:** GEV test method for determining the emissions of volatile organic compounds from building products in accordance with DIN EN ISO 16000 Parts 3, 6, 9 and 11 in a test chamber. Testing for CMR substances and TVOC/TSVOC after 3 and 28 days.

The corresponding test certificate (e.g. EMICODE licence, Blue Angel as per RAL 113) shall apply as **evidence**. If necessary, the results are to be provided in the form of the emission class.

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